

Serial No.: 10/642,916

REMARKS

Election/Restriction

The provisional election made during a telephone conversation between the Examiner and the undersigned representative is affirmed. Accordingly, claims 10-20 have been canceled to expedite prosecution of the application.

Claim Rejections - 35 U.S.C. § 102

Claims 21-29 have been rejected under 35 U.S.C. § 102(e) over U.S. Patent No. 6,465,866 to Park. Claim 21 has been amended to more clearly recite that which the Applicants regard as the invention. Claims 22 and 24 have been amended for consistency with the amendment to claim 21.

Claim 21 recites that a high-K liner conforms to the sidewalls of a trench isolation region and the liner has a relative permittivity, or K, of about 10 or more. An additional discussion of high-K materials can be found in the specification at page 4, line 23 to page 5, line 3, among other locations. It is noted from this passage that materials having a K value appreciably lower than 10 are considered to be standard-K materials.¹ Standard-K materials, as defined by the Applicants, include silicon oxide (e.g., SiO₂), silicon oxynitride and silicon nitride (K of about 6-9).

As claimed, the liner is used to exert a selected one of compressive stress or tensile stress on the active region to enhance carrier mobility within the active region. As described in the specification at page 5, lines 4-14, among other locations, compressive force can improve electron transport and tensile stress can improve hole transport. Since most devices that have a semiconductor active region are constructed to have only one type of carrier of interest, the claimed subject matter is directed to either exerting compressive stress or tensile stress on the active, but not both. Exerting

¹ It is reasonable to assume that K values that are 10% lower than 10 (i.e., a K of 9 or less) are appreciably lower than the claimed "about 10 or more."

Serial No.: 10/642,916

both
types of stresses on the active region may lead to counteracting any performance enhancement gained by the preferred one of the stresses for the device in question.

Turning to Park, Park does not teach or reasonably suggest the claimed invention. Rather, Park discloses a technique for rounding top edges of an isolation trench and increasing oxidation in these location (see, for example, Park's abstract). The only disclosed material for Park's liner 50 is silicon nitride, which, as explained above, does not fall within the claimed class of materials that have a relative permittivity of about 10 or higher.

In addition, Park's silicon nitride liner 50 plays a role in purposefully causing tensile stress of the substrate (region B in figure 7) as well as producing compressive stress (region A in figure 7). For a more detailed explanation of the dual stressing of the substrate, attention is directed to column 7, lines 8-32. The relative differences in stress are used to vary oxidation rates of the substrate to achieve the oxidation profile desired by Park. Park does not suggest that carrier mobility could be improved as a direct function of the stress exerted by the liner 50. Moreover, it is submitted that the presence of both types of stress exerted by Park's liner would at least partially counteract each other for purposes of enhancing carrier mobility.

It is further noted that the passage referred to by the Examiner (column 7, lines 55-65) describes a compressive force on the top edges of the substrate that would be present in the absence of Park's liner 50 (see, column 7, lines 53-67, inclusive of lines 55-65). Specifically, the liner 50 is used to prevent oxidation that would result in compressive stress from oxidized substrate material. Therefore, the compressive stress discussed in this passage is not exerted with the liner as claimed.

For at least these reasons, claim 1 and claims 22-29 depending therefrom are considered to patentably define over the cited references. Accordingly, reconsideration and withdrawal of the rejection under 35 U.S.C. § 102 is respectfully requested.

Serial No.: 10/642,916

Claims Rejections - 35 U.S.C. § 103

Claim 30 is rejected under 35 U.S.C. § 103(a) over Park in view of U.S. Patent No. 6,008,095 to Gardner.² Claim 30 depends from claim 21 and is considered to be allowable for at least the reasons identified above.

In addition, the liner 120 used by Gardner is not a high-K liner. The liner 120 is formed by NO oxidation of the semiconductor substrate (see, column 4, lines 43-54), which would result in, for example, silicon oxynitride having a K value of about 4 to 8 depending on the relative concentration of oxygen and nitrogen. Although it is acknowledged that the gate dielectric layer 104 in Gardner can be a high-K material, there is no suggestion to make the liner 120 from a high-K material. The passage cited by the Examiner (column 4, lines 60-65) refers only to the use of the NO oxidized liner 120 together with the high-K gate dielectric 104 and cannot be reasonably interpreted as forming both the liner and gate dielectric from high-K material.

Accordingly, reconsideration and withdrawal of the rejection under 35 U.S.C. § 103 is respectfully requested.

Conclusion

In light of the foregoing, it is respectfully submitted that the present application is in condition for allowance and notice to that effect is hereby requested. If it is determined that the application is not in condition for allowance, the Examiner is invited to initiate a telephone interview with the undersigned attorney to expedite prosecution of the present application.


² The Office Action does not identify the Gardner reference by patent number, but in a telephone message left by the Examiner for the undersigned representative on November 24, 2004, it was communicated that the '095 patent was the intended reference.

Serial No.: 10/642,916

If there are any additional fees resulting from this communication, please charge same to our Deposit Account No. 18-0988, our Order No. G0603.

Respectfully submitted,

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